

JSC Senior Design Project and or Intern Request Form

ES-3

Project Title:	Hypervelocity Impact Modeling on Windows		
Project Description:	Correlation and Improvement of Hypervelocity Impact Modeling of Micrometeoroid or Orbital Debris Impacts onto Glass or Acrylic Windows		
Choose most appropriate area of research:	<input type="checkbox"/> Planetary Surface Systems <input type="checkbox"/> Ground Operations <input type="checkbox"/> Propulsion <input checked="" type="checkbox"/> Spacecraft <input type="checkbox"/> Human Health Program		
Program Applicability	<input checked="" type="checkbox"/> ISS <input checked="" type="checkbox"/> CEV/SLS <input checked="" type="checkbox"/> Commercial Crew <input checked="" type="checkbox"/> Asteroid <input type="checkbox"/> Adv. Technology (AES/STMD)		
Choose one project:	Roles and Responsibilities of Senior Design POC/Mentor		
<input checked="" type="checkbox"/> Senior Design	I have coordinated with my management and I am able to support at least three (3) teleconferences (kick-off, mid-term, and final) with a Senior Design Project Team at a university that chooses my project. I understand that I shall not provide any sensitive or classified information to the Senior Design Project students of faculty. I will provide feedback to the project team if requested.		
<input type="checkbox"/> Internship	I have coordinated with my management and I am able to support an intern. If an intern is selected for my project, I will provide an environment where an intern can grow and we may have a mutually beneficial and successful internship. My project will be able to provide a desk space, work area, and computer for an intern. I will review any final report or presentation that the intern generates during his/her internship and submit it to Export Control (DAA) for approval. This project opportunity will be posted in OSSI, through the office of Education (use exact same title). OSSI website: : https://intern.nasa.gov		
Check desired Timeframe for Internship:	<input checked="" type="checkbox"/> Year long <input type="checkbox"/> Summer <input type="checkbox"/> Fall <input type="checkbox"/> Spring		
Check desired Major/Minor(s) for Internship:	<input checked="" type="checkbox"/> Aerospace Engineering <input type="checkbox"/> Aeronautical Engineering <input type="checkbox"/> Astronautical Engineering <input type="checkbox"/> Biomedical Engineering <input type="checkbox"/> Chemical Engineering <input type="checkbox"/> Civil Environmental <input type="checkbox"/> Health Engineering <input type="checkbox"/> Electrical, Electronic Engineering <input type="checkbox"/> Computer Engineering <input checked="" type="checkbox"/> Engineering Physics <input type="checkbox"/> Industrial Manufacturing Engineering <input checked="" type="checkbox"/> Materials, Metallurgical Engineering <input checked="" type="checkbox"/> Mechanical Engineering, Mechanics <input type="checkbox"/> Nuclear Engineering <input type="checkbox"/> Astronomy, Astrophysics <input type="checkbox"/> Chemistry <input type="checkbox"/> Optics <input checked="" type="checkbox"/> Physics <input type="checkbox"/> Atmospheric Sciences <input type="checkbox"/> Geography <input type="checkbox"/> Geosciences <input type="checkbox"/> Oceanography <input type="checkbox"/> Natural Resource Management <input checked="" type="checkbox"/> Mathematics, Applied Mathematics <input type="checkbox"/> Computer Science <input type="checkbox"/> Astrobiology <input type="checkbox"/> Biology <input type="checkbox"/> Biochemistry/Biophysics <input type="checkbox"/> Microbiology Bacteriology <input type="checkbox"/> Chemical Engineering <input type="checkbox"/> Other, please specify:		
Mentor Name:	John W. Alred	Mentor's E-mail:	john.w.alred@nasa.gov
Title & Organization:	Deputy Branch Chief (Acting), Materials and Processes Branch / ES4	Phone #:	281-483-5939
Alternate POC/Mentor Name:		Alternate's E-mail:	
Education Office Signature and Date:		Intern Mentor's Signature & Date:	<i>John W. Alred</i> 5/28/13
As supervisor/manager, I approve of the above named individual as Senior Design Project POC of Intern Mentor.		Supervisor/Manager's Signature & Date:	<i>Pavel Kravtsov</i> 06/11/13
(For Intern Request Only) As Administrative Officer, I am aware that the above named Intern Mentor has submitted a request for an Intern.		Administrative Officer's Signature & Date:	<i>Dera A. Yockov</i> 6/11/13

Title: Hypervelocity Impact Modeling on Windows

Sponsor: NASA Johnson Space Center, Engineering Directorate, Structural Engineering Division, Materials & Processes Branch

Personnel: 1-2 Engineering/Physics Students

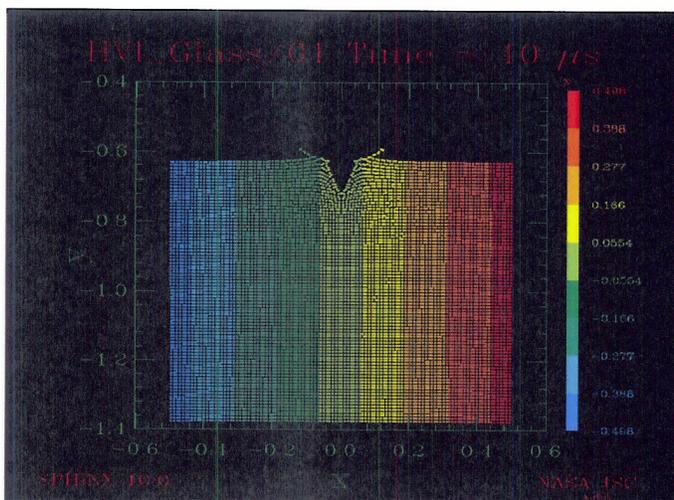
Expected person-hours: 400

Deadline: Spring 2014

Statement of Work:

After the MMOD impact on the Cupola Window #2, the Hypervelocity Laboratory group (KX) and ISS Materials and Processes (ES4) talked about the collaborative work they had done on this issue. While KX has a very good model for MMOD impacts, they have not done any direct comparisons of their simulations with the hypervelocity impact test data they have at WSTF. Also, the ES4 code that can simulate hypervelocity impacts uses a different numerical scheme than theirs (smooth particle hydrodynamics for ES4 and finite element for KX). Hence, the ES4 data/simulations are always appreciated by KX as a great sanity check. The task would be to come up with some quick-look criteria of when a window that has been impacted is OK. So, not only would the task involve simulations to compare to the KX WSTF data, but also would look at the fracture mechanics of the glass during and after impact as well as coordinating with KX and the ISS Structures & Mechanisms team. This could help ISS in its life as more impacts are expected and this would be sort of pre-work to alleviate a formal investigation for each impact noted.

The objective of this project will be the correlation and improvement of hypervelocity impact modeling of micrometeoroid or orbital debris (MMOD) impacts onto glass or acrylic windows. Test data from samples of glass and acrylic that have been impacted by known particles traveling at measured hypervelocity speeds will be provided to compare to numerical simulations. Improvements to the numerical code to allow reproducibility of impact features will be developed.



SPHINX Simulation



MMOD Impact on ISS Cupola Window